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HISTORY OF THE INTERNATIONAL MORSE CODE

By LTJG Robert W. Jones, USN,

ABOUT THE AUTHOR – LTJG Robert W. Jones enlisted in the Naval Communication Reserve in Canton, Ohio, in 1937, reported for active duty in 1940, and has since served continuously in various Naval Security Group billets. Appointed a warrant officer in 1956, he was promoted to CWO (W-2) in 1959 and to his present rank in January 1963. LTJG Jones has been a licensed amateur radio operator since 1934, and now holds call letters W6EDG and K3RXO. In 1956, while serving as an instructor at CT School, Imperial Beach, Calif., he copied plain language at 52 WPM to win first place in a code-copying competition among members of the school staff. LTJG Jones' wife and daughter live in Washington, D. C.; his son, Frederick C. Jones, is a Midshipman at the California Maritime Academy.

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HISTORY OF THE INTERNATIONAL MORSE CODE

By LTJG Robert W. Jones, USN,
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In 1832 while returning to the U. S. on the packet Sully, Samuel F. B. Morse, a well known portrait painter, participated in a discussion on the speed of an electric current through 100 feet of wire. Morse suggested that if the current's travel was instantaneous, it could be used to convey intelligence for any distance. The idea took deep hold on Morse, and he immediately made sketches and drafted the first of several "Morse Codes."

Perhaps unknown to Morse, other inventors in Europe were working to develop electric telegraphs to replace the relatively slow visual telegraph that had been in operation as early as 1796, when a visual telegraph was in operation between London and Dover.

The most efficient visual signalling system at that time was the method invented by Colonel Paisley of France in 1822. The towers of the Paisley semaphore were placed from three to five miles apart; each was visible to the nearest on either side. The positioning of the two arms conveyed letters or words. Twenty-seven of these towers connected Calais and Paris (152 miles). A word was transmitted through in three minutes, a sentence of ten words in half an hour. Probably due to large unpopulated areas and the distances between large cities, the visual telegraph was not used in America.

In 1809 Doctor Sommerring of Germany invented a novel type electric telegraph, using twenty-seven wires between the two signalling stations. The wires terminated in a small, water-filled reservoir at the receiving set. Letters of the alphabet were indicated by energizing the wires representing the letters of the text to be transmitted. The wire termination in the reservoir bubbled and signalled to an alert and watching operator the letters being transmitted. Sommering's telegraph was never in commercial operation, although it attracted much attention in Europe.

In 1811 Schweigger of Nuremberg suggested that only two wires be used and that the duration of the bubbles and the spacing be used to convey the letters of the alphabet. This is possibly the first suggestion of a telegraphic alphabet for signalling over a single electric circuit.

Baron P. L. Schilling of Russia saw Sommerring's telegraph in operation in 1810. From that day, Schilling's favorite study was electricity. During the years until 1825, Schilling divided his time between a diplomatic career and his experiments with the electric telegraph. Schilling's method of transmitting intelligence used the magnetic field surrounding an inductance to deflect a magnetic needle. Line current in one direction deflected the needle and turned the white side of the round card suspended on the string toward the operator. Reverse line current moved the needle in the opposite direction and showed the black side of the card. In the code used by Schilling, the letter b indicates the black side of the card, w the white side. The line current had three states: normal, reverse and off. Only normal and reverse currents were used for signalling. In the Schilling alphabet, if the black is assumed to be a dot and white a dash, some of the letters (A, E, I, N, T) are the same as the present International Morse Code. Baron Schilling died in 1837 before he could construct the telegraph line that had been ordered built by Imperial decree. Schilling's design influenced European telegraph design for many years. Many needle telegraph systems were used in Europe.

Gauss and Weber of Germany developed a code to be used on their 1 1/2 mile telegraph line. The Weber-Gauss indicating instrument is interesting in its size. The

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movable bar magnet was 18 inches long and had a 3 x 5 inch cross-section. The huge 100 pound magnet was mounted in the center of an inductance, wound with 3,000 feet of wire. A small mirror was attached to the magnet. The slightest movement could be detected by watching the mirror through a telescope ten feet away. This system did not find wide usage on European telegraph circuits, but the principle was adopted years later by Sir William Thompson when he developed instruments used to detect very weak impulses on the first trans-Atlantic cables.

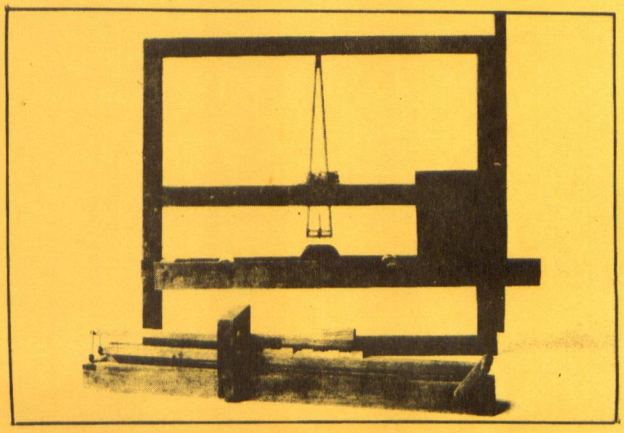
The needle telegraph continued development in Europe. Many lines were installed, and the system was in commercial operation prior to the practical use of Morse's system in America.

S. F. B. Morse designed his first telegraph to be, as he called it, an "Electro Magnetic Printing Telegraph." Morse's system used the new electromagnetic theories of Joseph Henry, an American who did extensive work in the field of electromagnets and translated the off-on impulses of keyed telegraph lines to marks on a moving strip of paper.

Morse's first telegraphic code was a dot/space combination that was capable of transmitting one through zero and a space. One and six were each one dot. The numerals were discriminated by the space following the last dot of the numeral. Using one dot as the basic unit, the numerals one through five were each followed by a space of three units. The numerals six through zero were each followed by a space of five units. The space was six units. Morse was close to the system of Baudot and his uniform length, baud-based code.

Since spacing was an important part of Morse's code, the element of human error was removed by using a mechanical method of transmitting the dots and spaces of the code. The metal bars with teeth were attached to a portrule and pushed under a pin that lowered two wires into mercury cups, sending the dots and spaces of the message. Such a system required that each message first be reduced to numbers, using a complete dictionary compiled by Morse. At the receiving terminal, the numbers were translated back to English. Morse continued his tests for several years and ultimately dropped the number code system. The first Morse alphabet is believed to have been developed in 1835.

In 1837, while Morse was demonstrating his telegraph apparatus in New York, Alfred Vail became interested in Morse's telegraph and entered into a partnership with Morse. Vail obtained financial backing and the two inventors refined and developed telegraph instruments.



Morse's first telegraph instrument. The receiving register was built on an oil painting frame. Transmitting portrule is in foreground. Morse worked with this system, later abandoned it for a dot-dash alphabet and more efficient register.

In January 1838, the amended Morse alphabet was introduced and used to send a message through ten miles of wire at a public demonstration. In the amended Morse alphabet, G and J, I and Y, S and Z are each represented by one dot and dash combination. The correct letter had to be determined by context. The ampersand (&) was commonly used then, even in formal writing and was included as one of the characters of the alphabet. The morse ". ..." was assigned to represent it. This character is still extensively used by radiomen for "and."

The amended Morse alphabet has been attributed to Vail, who, it is claimed, worked out the dot, dash and space symbols for the final Morse code after watching a printer at work over a font of type. The most frequently used letters were in the largest compartments in the printer's case, and Vail, therefore, made the most frequently used letters the shortest in dots, dashes

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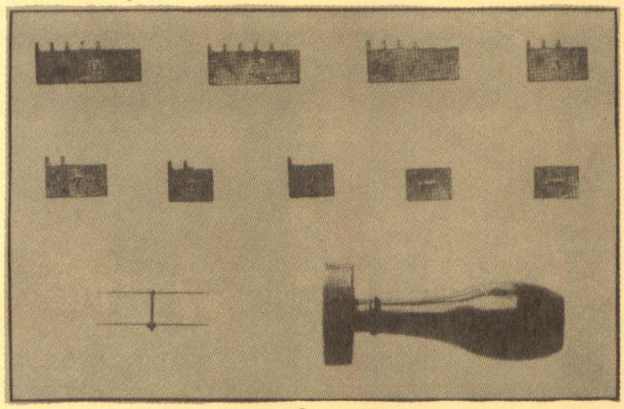
and spaces. Separate dot and dash equivalents were later worked out for the J, Y, and Z.



Seven of the type-like sections that were affixed to the portrule to transmit the dots of Morse's first code. Both 5 and 0 are five dots, but the space following the last dot is greater on the 0 than the 5. All 10 numerals are not shown. The numerals are, top to bottom, left to right: 0, 5, 9, 3, 7, 2, 6, space, space. Devices at bottom probably were used to push types into portrule.

Morse's alphabet had inherent faults. Several of the letters had spaces within them and were easily mistaken for two other letters. The T, L and zero were each represented by one dash, but dashes of different lengths. In the spring of 1844, Morse and Vail, after an unsuccessful attempt to install the line underground, were testing the overhead line between Washington and Baltimore, using a Morse register.

In May 1844, about two weeks prior to sending the famous "What Hath God Wrought" message, Morse wrote a letter to Vail about some of their tests on the new telegraph line. "Everything worked well yesterday, but there is one defect in your writing (sending). Make a longer space between each letter, and a still longer space between each word."

That trouble hasn't been limited to the inventor of the telegraph. Every beginner, as we all know, runs the letters and words together.

Morse's instruments spread over the continent. The early telegraphers sent by hand, but read the tape visually after the dots and dashes had been printed by the register. After the telegraphic registers had been in use for several years the operators discovered that they could read the clicks of the armature moving up and down as it actuated the writing pen. Morse opposed reading by sound, but the operators continued reading by ear, and soon the registers were reduced to only the electromagnet and movable armature to make a readable click.

In Europe the needle telegraph continued in use. Only Germany seemed interested in the Morse-type telegraph. The first European line using the Morse system was installed in 1848 between Hamburg and Cuxhaven. One of the officials of the line, Gerke, introduced some changes to the American Morse Code that eliminated the troublesome spaces within characters and standardized the dot as the basic unit and the dash three times the length of a dot. Gerke also constructed a new set of dot-dash combinations for numerals and punctuation.

In 1851 the German-Austrian Telegraph Union met to standardize telegraphic communications between the two countries. The telegraphic union agreed to use, effective from 1852, the modified Morse alphabet worked out by Gerke in 1848. This alphabet was named the Austro-Germanic Morse Alphabet.

Morse's original alphabet continued to be used in America and was known as

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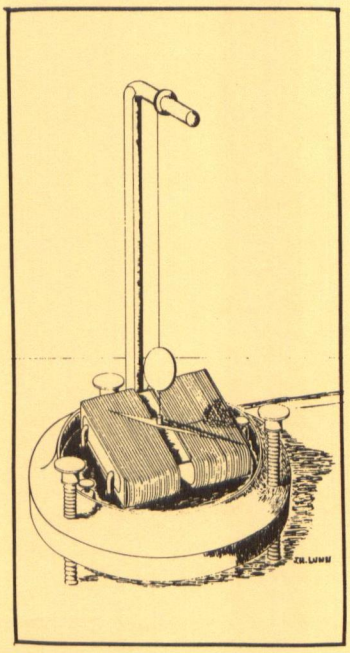
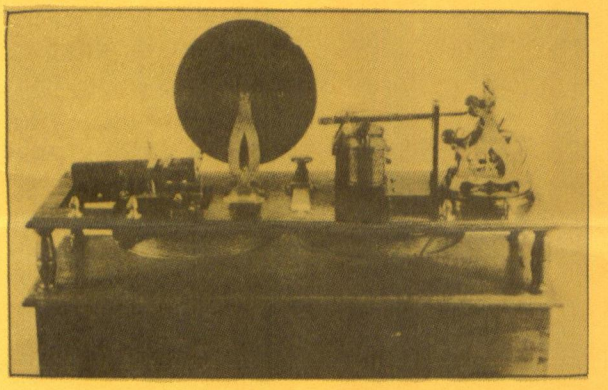


Early needle telegraph receiving instrument designed by Baron Schilling of Russia. Receiving operator read the message by watching the round card suspended above the needle. Normal line current turned the white side toward the operator. Reverse line current turned black side of card toward him.

American Morse. Although Morse had only devised an alphabet, the ampersand and ten numerals, punctuation evolved, and by 1855 three were in use.

One story is that the first telegraphers, having no error sign or question mark, spelled out the word "DAMN" when an error was made during sending. This was soon shortened to "DN" and later contracted to "-..-.". The dot-dash combination -..-. became the American Morse symbol for question mark and error sign.

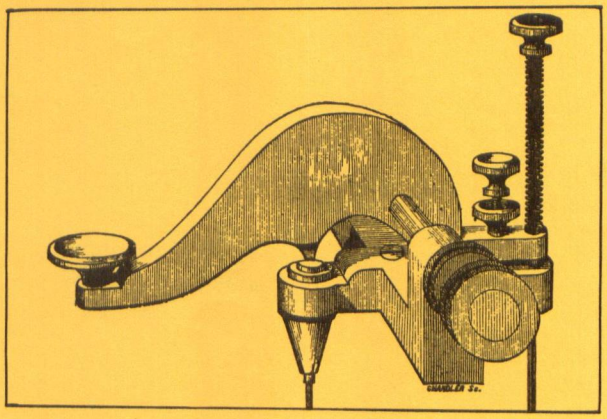
The Austro-Germanic code continued to be used in Europe and was later referred to as Continental Morse Code. Morse systems slowly replaced all others in Europe and Continental Morse Code became the common telegraphic code in Europe.



Morse register, used about 1846. The horizontally-mounted coils beneath the top shelf are the windings of the line relay. The vertically-positioned coils on the top shelf acted on the armature, which pulled the printing pen against the moving paper strip. The transmitting key is mounted in the center. The printing register was gradually replaced by operators reading the audible clicks of the moving armature.

When wireless telegraphy was born in Europe, the first wirelessmen used Continental Morse Code. American wireless operators used American Morse.

The book "Instructions for the Use of Wireless Telegraph Apparatus" by LT J.M. Hudgins, USN, 1903 Edition, lists three codes that could be used for communicating. The Navy Code Alphabet had been the U.S. Army and U.S. Navy "General Service Code" and had been used for telegraph and visual use.



Early Morse transmitting key

Instructions to Navy wirelessmen of 1903 left it to the whim of the operator which code to use: "Any dot and dash code may be used for signalling. The Continental Morse, the Navy Signal and the American Morse Code are given. The American Morse is not suitable for a tape record owing to the spaces in the letters." Wireless receivers of that era used coherer detectors that printed dots and dashes on paper tape.

By 1912 the Navy had dropped the Navy Signal Code and made Continental Morse the official Navy telegraphic code. The following is quoted from the Manual of Wireless Telegraphy for the Use of Naval Electricians, 1912 edition: "For official use between ships of the navy and between them and naval shore wireless stations, the Continental Morse Code is used. Commercial shore stations in the United States and United States coasting vessels use American Morse. It is hoped that the use of wireless telegraphy will eventually bring about an international agreement and provide a universal code. This will facilitate intercourse between United States ships and those of other nations and relieve operators of the necessity of learning two codes."

The Navy's hopes were fulfilled. Soon after 1912, the transition took place to complete usage of Continental Morse Code for radio communications. However, it was not until the International Telecommunications Union convention of 1927 in Washington that the Continental Morse Code was officially adopted as the International Morse Code. The code as adopted was basically the same as

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the Austro-Germanic code set up by Gerke in 1848 and adopted by the Austro-German Telegraph Union in 1851. A minor revision was made, following ITU agreement, in 1937, when some of the punctuation marks were changed.

American Morse is still in use on the few remaining manual telegraph lines in the United States, but is slowly being replaced by teletypewriting machines. The International Morse Code is still extensively used in radio communication.

Although machines are handling all the heavy traffic loads, the good operator with the selective ear, pride in his fist, and the ability to do what machines cannot do will always have a place in U. S. Naval Communications.